NATURAL ENVIRONMENT

"The soil is the great connector of our lives, the source and destination of all."

- Wendell Berry
"The Unsettling of America", 1977

Historically, the natural environment has played an important part in the development and livelihood for East Mountain Area residents. The natural resources have provided farmlands, wildlife and game habitat, minerals, wood, and homesites. The impact upon the natural environment from development has ranged from low-intensity farming communities, to suburban subdivisions, to intense modification within the Department of Energy/Kirtland Air Force Base Withdrawal Area. The natural environment in the East Mountain Area is vulnerable to degradation due to the area's unique combination of steep slopes, shallow soils, fractured bedrock, dependence upon ground water, scenic beauty, and the lack of urban water and sewer facilities.

Environmental degradation can occur from improper use of the natural resources including indiscriminate tree cutting, overgrazing by family horses, inadequate control of increased run-off, and poor construction and siting of buildings and on-site liquid waste disposal systems..

Environmental and rural character issues accounted for most of the concerns expressed in the citizen survey and at the public meetings. The following section provides information concerning the existing environmental conditions in the East Mountain Area along with an analysis concerning the value, opportunities, and constraints as they affect growth and development in the East Mountain Area.

SLOPE

The East Mountain Area is located on the eastern slopes of the Sandia and Manzanita Mountain ranges. The northern portion of the Manzano Mountains and Monte Largo of the San Pedro Mountain Range are also included in the East Mountain Area, which encompasses 316 square miles or 23 percent of Bernalillo County's total land. From the highest elevation in the northwest corner of the East Mountain Area, the terrain slopes eastward toward the Estancia Valley. The elevation at the highest point is 10,678 feet at Sandia Crest, and in two places descends to a low elevation of 6,000 feet along Interstate 40 in Tijeras Canyon in the vicinity of the Village of Carnuel, and south of Mount Washington near North Canyon at the southwestern corner of the area, for a total change of 4,678 feet.

The most prominent land features of the area are the mountains: The Sandias in the northwest corner of the area; the Manzanita in the southeast corner; and Monte Largo, which is located in the northeast corner of the area, east of State Highway 14 and mostly within the San Pedro Grant Boundary.

The East Mountain Area can be characterized as generally steep in slope. Although slopes in the area range between 0 – 25+ percent, slopes of 15 – 25 percent cover the largest portion of the total area. Slopes within this range predominate in the mountain areas and extend east until the slope begins to flatten near the villages of San Antonito, Sedillo, Juan Tomas, Yrisarri, and Escobosa.

Slopes of 25+ percent or greater occur much less frequently and are found mostly along the ridge of the Sandia Mountains and on its west face. Slopes of the degree are also found in the Manzanita Mountains at the north end of the range along the ridge, on the west face of the mountain, and in pockets clustered near Lurance Canyon and Mount Washington, which extend southward to Hell Canyon.

(Insert Map of Slope Analysis)

Slopes of 10 – 25 percent occur near the bases of the foothills and valleys in small- to medium-size pockets, which are scattered over the entire area. Larger areas in this slope range dominate the landscape as the influence of the steeper mountain slopes diminish toward the Estancia Valley near San Antonito, Sedillo, Juan Tomas, Yrisarri, Escobosa, and Chilili.

Slopes of 3 – 10 percent are infrequent, although fairly generous pockets exist north of San Antonito along Hwy 14, northeast of Sedillo along Route 306, northeast of Yrisarri, in the vicinity of Escobosa and Chilili where several medium to large areas exist, and five areas in the Manzanita Mountains; two within the boundaries of the Cibola National Forest, and three in the Isleta Indian Grant. Many small pockets of 3 – 10 percent slope also exist and are scattered mostly along the western third of the area.

Shallow slopes of 0 – 3 percent are scarce and are found only in the area south of Yrisarri, near Escobosa, Chilili, and Old Chilili.

SLOPE DEVELOPMENT OPPORTUNITIES

Changes in elevation provide several developmental benefits to the property which include:

Creative Planning

Creative designs can be stimulated by variations in topography and elevation.

Views

The upper elevations have impressive panoramic views of the Sandia and Manzanita Mountains to the west, Monte Largo to the north, and the Estancia Valley to the east.

Buffering

Changes in elevation usually provide opportunities for buffering between different land uses and residential developments.

Drainage

Steeper slopes challenge future development with the need for creative design solutions that are appropriate and compatible with their special conditions.

CONSTRAINTS

Areas where slope exceeds 15 percent are particularly sensitive environments and must be treated with special consideration. Suitable development can still occur in these areas if enough land is available for appropriate siting of buildings, minimized grading, and contoured roadways. Hillsides in an undisturbed state maintain an equilibrium between vegetation, geology, slope, soil, and precipitation. Development can easily disturb the existing balance if careful consideration is not given to planning for specific needs that protect against disruption of vegetation, occurrence of erosion, and destruction of the visual landscape.

Slope is of particular concern in the East Mountain Area because of its impact on drain-field operations and on-site wastewater disposal. Slope, combined with the shallow soils, fractured bedrock, and close proximity of septic tanks and water wells, has contributed to water pollution problems in many areas. The State and County are both considering tougher regulations governing new and existing septic tank use in the East Mountain Area, and slope will be a significant criteria for permitting in the future.

WATER

"You pull the string on a folded-up Chinese paper flower and it pops into being, replete with many serene oriental colors – so the mesa sprouts alive just seconds after the rain and hustles full-tilt toward its own brand of muted glory."

- John Nichols
"A Fragile Beauty, John Nichol's Milagro County"

Water is one of the most valuable natural resources for the East Mountain Area. At present, almost all of the domestic, commercial, and agricultural water used in the East Mountain Area comes from ground-water supplies. In order to ensure that this supply is available for use in the future, the community must take measures to protect this valuable resource.

"New Mexico's pervasive water lore originates in scarcity. Em Hall states: 'Not much precipitation falls here…. What does come down falls unevenly over the state (8 inches in the barren plains, 30 inches on the mountain peaks), and at irregular times (mostly in July and August, seldom in June and October). This yields roughly 85 million acre-feet of water a year, or enough water to cover 85 million acres one foot deep… putting New Mexico very near the bottom of state rankings in terms of water produced for surface area. Only some three million acre-feet of the comparatively puny eight-five million appears annually as surface water running in streams.' Hall's statistics are but one contemporary expression of the long-standing recognition that survival in an arid environment requires ingenuity, luck, work, and ritual."

- Marta Weigle and Peter White
"The Lore of New Mexico", 1988

In order to understand the water resources in the East Mountain Area, it is important to examine the entire Hydrologic Cycle. The Hydrologic Cycle contains water in its many natural states, which includes:

PRECIPITATION

Precipitation in the form of rainfall or snowfall varies in the East Mountain Area in intensity and amount, not only from season to season (the mid-summer and mid-winter have the most), but according to topographic features and elevation. In the East Mountain Area the rapid changes in elevation result in a wide variation in the amount of annual precipitation between the higher and lower elevations. For example, at the Sandia Crest (over 10,000 feet) annual precipitation can be as high as 40 inches, while in the lower elevations in the eastern part of the study area the annual precipitation drops to 20 inches or less.

The areas of higher elevations, due to the increased precipitation, have more varied vegetation cover which act as water retainers and collectors, slowing the runoff and allowing maximum infiltration back

into the aquifer. Most of the higher elevation mountain areas in the East Mountain Area are under the control of the National Forest Service.

SURFACE WATER

In the East Mountain Area perennial streams are few and limited in length, surfacing at springs and flowing only short distances. Most of the surface water is in the form of intermittent streams running only during periods of high rainfall. The scarcity of perennial water sources and the associated riparian habitat areas, make these springs, streams, and wetland areas exotic; they contrast with the typically arid East Mountain landscape.

(Insert Map of Elevation in Feet)

GROUND-WATER

Ground-Water is defined as the water in the ground that is held, moves, or drains freely by gravity. The zone of saturation, or aquifer, is that part of the substrata in which all voids and openings are filled with water.

The East Mountain Area geology primarily consists of consolidated rock which varies greatly in terms of ground-water production capabilities. A large portion of the area is fractured Madera limestone, which is generally capable of supporting low-yield wells sufficient to supply up to several households. However, due to the low intensity of fractures throughout the area, one out of every five wells drilled is dry (Titus, 1980). There do appear to be several high yield zones which have been reported to produce yields of 1,000 gallons per minute or more.

1) Factors influencing the availability of ground-water in the East Mountain Area:

- Amount of precipitation.
- Porosity and permeability of substrata
- Particular underlying geologic formation of the area
- Usage levels

At present, there are no reliable estimates of the total amount of ground-water in the East Mountain Area. There are two reasons for this fact. One, the highly faulted nature of the subsurface geology complicates predictability from one area to another, and two, a high cost factor associated with the large number of pumping tests needed to obtain a complete water quantity profile. The USGS is presently under contract with the City of Albuquerque and Bernalillo County to study water quality and quantity in the East Mountain Area.

2) Yield

Permeability of most of the water producing strata (or aquifers) is such that they do not yield enough to be used in community systems (community wells usually require production of 100 or more gallons per minute). Most of the wells drilled in the area have been low yield wells

adequate only for domestic use. There are presently twelve community water systems providing service to the East Mountain Area. (See attached Existing Water system Service Area Map).

At present, the New Mexico State Engineers Office regulates water rights, appropriations, community systems, and private domestic well permits. The State Engineers Office currently defines domestic use as less than 3 acre feet per year (977,550 gallons). Current consumptive use in the East Mountain Area is approximately 75,000 to 90,000 gallons per household per year. The allowable, or appropriated, water per individual domestic well is over 10 times the amount required for a typical household without agricultural use.

Another area of concern in the East Mountain Area is the fact that the State Engineers Office currently does not allow the consideration of recharge in determining the water availability within the individual ground-water basins. This makes it impossible to consider a balance between development and its consumptive water use and the hydrologic cycle. However, the East Mountain Area Water System Feasibility Study, prepared by Molzen-Corbin & Associates in 1990, attempted to determine a range of self-sustaining lot size requirements which would balance consumptive use per household with recharge and return flows. Their analysis indicates that, in general, a lot size of 2 acres exceeds the carrying capacity of the regional ground-water supply. The following table (**TABLE #1**) shows the range of possible sustained yield lot sizes based upon various recharge and water usage rates. The estimated recharge rate generalized for the East Mountain Area is .5 inches per year and the existing consumptive use is approximately 100 gallons per person per day. These assumptions would indicate that the minimum lot size to balance recharge and consumptive use in the East Mountain Area is four acres.

Table 1
MINIMUM LOT SIZES (ACRES) FOR SUSTAINED USE OF EMA WATER RESOURCES

Demand		Recharge Rate (inches / year)			
		0.1	0.3	0.5	1.0
Per Person (gpcd)	Per Household (gpd)	Lot Size in Acres			
75	160	15	5	3	1.5
100	213	20	6.67	4	2
125	266	25	8.33	5	2.5
150	320	30	10	6	3

Source: Bernalillo County East Mountain Area Water System Feasibility Study, 1990.

(Insert Map of Water Master Plan)

3) Contamination

The East Mountain Area, due to its sensitive environmental conditions and limited ground-water supply, is very vulnerable to potential contamination. Several cases of ground-water contamination have been documented in the East Mountain Area (**See TABLE #2**). The sources of groundwater contamination have either been leaking underground storage tanks (LUST) or septic tanks and drain fields.

(Insert Table 1.A – Groundwater Contamination)

The impacts of future land use planning on the area of water availability, quantity and quality within the East Mountain Area is one of the most critical issues to be addressed in the plan. The issues of water and wastewater were by far the most prevalent concerns expressed in the citizen survey prepared as part of this planning effort. The concerns in the East Mountain Area are compounded by the lack of community wastewater treatment systems. Over ninety-six percent of the survey respondents rely on individual septic systems. The interrelationship of precipitation, groundwater, consumptive use, wastewater treatment, and other environmental factors must be recognized and translated into land use regulations which addresses the vulnerability of the water supply in the East Mountain Area.

SOILS

One of the more severe environmental limitations to development in the East Mountain Area is the soil conditions. Most of the soils in the East Mountain Area pose severe limitations for the development of septic tank drain fields. The Ciudad Soil and Water Conservation District has provided Bernalillo County with a detailed analysis of the soil types existing in the East Mountain Area, limitations associated with those soils, and recommendations concerning septic tank drain fields and drainage velocities. This report is included as Appendix A in this document.

Many of the soils in the East Mountain Area are subject to severe water erosion. The characteristics of the soil, steep slopes, and the additional runoff from development significantly increase the potential for soil erosion.

These soil groups can be combined into three categories relative to septic tank drain field construction:

1. Category A

   Groups 1, 7 and 9. These soils have slight to moderate limitations for septic drain fields. While septic tank drain fields can be developed in these soils, careful design and site modification is required in order to ensure environmental acceptance.

2. Category B

   Groups 3 and 8. These soils have severe limitation; however, these limitations can be overcome through careful design and installation of the drain field.

3. Category C

   Groups 2, 4, 5 and 6. These soils have the most severe septic drain field limitation, and would require complete soil modification in order to develop a septic drain field. The Soil Conservation Service recommends that no drain fields be allowed in this soil category.

In summary, the soils in the East Mountain Area represent a significant constraint upon development. The soils on each development site in the East Mountain Area must be taken into consideration by Bernalillo County in order to ensure that an appropriate and non-polluting system is installed.

(Insert Map – Soil Groupings for Septic Fields)

DRAINAGE

Mountain Area streams are few and limited in length, surfacing at springs and flowing only short distances before drying up through infiltration or evaporation. Many of the streams are located in the higher elevations on Forest Service land and are most often found in the form of intermittent streams running only during periods of high precipitation. There are approximately 39 springs which vary between perennial and intermittent flow. There are three ponds, 1) Pine Lake located in the Sandia Park area, 2) one on the east side of North 14 near San Antonio, and 3) another at Seven Springs along Interstate 40 in Tijeras Canyon. Perennial water sources are scarce, making them a striking contrast to the rest of the area.

"Our natural springs ought to be state shrines."

- Kate L. Gregg
"The Road to Santa Fe", 1952

The area does receive significant amounts of precipitation through snowfall, and during the summer rainy season. Extensive site grading and the removal of vegetation can contribute to erosion and the potential for flood damage to property. Site development must be sensitive to the periodic high flows of snowmelt and thunderstorms, and appropriate drainage solutions including sediment transport analysis must be included in all development plans.

Multiple use of drainage areas should occur wherever possible; that is, arroyos can provide corridors for adjacent recreational trails, open space connections, and stormwater flows. When feasible, arroyos shall be left in their natural state to help maintain the rural character and natural environment of the area.

VEGETATION

"Plant chemical defenses play an important role in reducing herbivory and resource competition in piñon-juniper woodlands. Both juniper and piñon produce an arsenal of secondary compounds that, when released into the environment in sufficient quantities, may affect the growth and well-being of plants and animals that come into contact with them…. Volatile terpenes present in both the berrylike cones and the foliage of juniper give gin its distinctive taste and also lend their pungent aroma to the woodland. The fragrance of woodlands dominated by piñon pine is produced by the volatization of ethyl caprylate, a chemical compound also found in Zinfandel grapes. This same compound is responsible for the spicy-sweet woodsmoke that perfumes the air in towns wherever fireplaces and woodstoves are fueled with piñon. Furthermore, some of these defensive compounds inhibit the growth of fungi, making the heartwood of piñon and juniper highly durable and resistant to decay."

- Audrey DeLella Benedict
"A Sierra Club Naturalist's Guide to the Southern Rockies", 1991

1) Dominant Vegetation

The area is dominated by Piñon Pine, Juniper, and Gambel Oak, which cover many slopes and ridges and are frequently interspersed with grassland areas. There is evidence that some areas were once

cleared of low-lying shrubs to accommodate farming which expanded the grassland areas that naturally occur between peninsulas of ridges covered with Juniper and Piñon.

The upper elevations of the Sandia Mountains' eastern slopes and west face, (7,200 – 10,000 feet) are dominated by Ponderosa Pine, Piñon Pine, Douglas Fir and Gambel Oak with small pockets of Gambel Oak and aspen occurring between elevations of 8,000 – 10,000+ feet. This area supports a more varied vegetation cover due to increased precipitation, retention of runoff and infiltration back into the aquifer.

The east face of the Manzanita Mountains is dominated by shrubby grassland including Fourwing Saltbush, Indian Ricegrass, Sand Sagebrush, Yucca, Cholla, Broom Dalea, Black Grama, and Dropseed.

The vegetation cover of the Manzano Mountains to the east is predominantly grassland with large pockets of Ponderosa Pine, Piñon, and Gambel Oak occurring on western slopes. Eastern slopes are a mixture of Piñon Pine, Juniper, and Gambel Oak frequently interspersed with large areas of grassland which continue toward the Estancia Valley.

The primary source of change to the vegetation in the area in the last two decades has been a direct result of development and the associated increase in population. Development is clustered along I-40 in the vicinity of the villages of Carnuel and Tijeras, along North 14 in the vicinity of the villages of San Antonio, Cedar Crest, Cañoncito, Sandia Park, San Antonito and north off of State Road 306 in the residential development of Sandia Knolls. Low-density residential development is also dispersed throughout the area, and some sites have been cleared of all significant vegetation. As the mountain vegetation is one of the most significant elements of the East Mountain Area's rural character, measures must be taken to protect significant vegetation during and after construction of any new development.

"Since European settlement of North America, we've gone from native flora to mostly an exotic one, and now we are working our way back to native, environmentally adapted plants, with perhaps a few genetic manipulations thrown in. Sadly, it took us two hundred years to make this circle, and two hundred years from now, we'll probably still be battling weeds while we were making the circuit."

- Stephen Clubine
"Native Warm-Season Grass Newsletter", 1990

2) Benefits provided by Vegetation

a. Vegetation moderates the effects of winds and storms, stabilizes and enriches the soil, slows runoff from precipitation and increases groundwater infiltration.

b. Vegetation buffers the sights and sounds of civilization, mutes noise from freeways and factories, and absorbs some air pollutants.

c. Forest vegetation moderates climatic extremes. Microclimates created by woodlands keeps air at an even temperature partly through shading provided by trees and transpiration of water from leaves.

d. The environmental diversity of woodlands is an important resource for wildlife conservation, environmental health, and recreation.

3) Constraints Resulting from Loss of Vegetation

a. Loss of vegetation cover and a growing number of impervious surfaces can decrease infiltration of precipitation back into the aquifer. This endangers the aquifer's natural cycle of regeneration and contributes to the likelihood of flooding and erosion.

b. The removal of vegetation from the landscape deprives the soil of the stabilizing function of roots, as well as the moderating effects on wind and water erosion of leaves and branches. In arid areas and in regions where the soil mantle is very thin, even short periods of no cover, especially during periods of heavy precipitation or melting, can erode enough of the soil to make replacing lost vegetation difficult, if not impossible.

c. Disturbance of vegetation can destroy a community's aesthetic resources. Hills, ridges, and meadows frequently mark boundaries and serve as landmarks, which provide a sense of orientation and identity for homes and other buildings in a community.

VISUAL ANALYSIS

Prominent views are found looking both to and from the numerous mountains and valleys of the area. To the north are views of the Sandia Mountains, and Monte Largo. From some areas views continue to the Sangre de Cristo Mountains approximately 50 miles to the north. To the south, there are significant views of the Manzanita and Manzano Mountains, and to the east of the Estancia Valley.

Upper elevations provide many opportunities for impressive panoramas that usually include all or most of the geographic features of the area. Middle elevations also offer many views of great scenic beauty in which V-shaped canyons, grasslands and meadows, and broad, shallow, dry washes in the middle ground landscape are juxtaposed against backgrounds of mountain peaks and ridges. Lower elevations offer monumental views of the mountains from clearing, meadow and grassland areas. Sandia Crest (10,678 feet) and Manzano Peak (10,098 feet), the highest points in the area, are the major focal points which are visible from most elevations and directions. Another important natural landmark is Cedro Peak (7,767 feet) which is visible from I-40 to the south of the village of Tijeras.

The natural scenic quality of the East Mountain Area is vulnerable to significant impacts from development and the scenic qualities of several historic pastoral landscapes and wooded ridgetops have been destroyed. The open valley meadows, whether used for farming, grazing, or open space, with their wooded walls of piñon forest create a scenic quality not available anywhere else in the Albuquerque Metropolitan Area. Wooded ridgetops also provide a sense of visual openness and provide a visual balance to existing development. If the beauty and scenic characteristics of the East Mountain Area are to be maintained, then these casual elements must be preserved.

It will be important throughout future development to preserve views of the mountains and valleys of the East Mountain Area, in order to retain the sense of identity and rural character that mountains and hills impart to the region. Projects which retain most of the vegetation and distinctive features (such as hilltops, outcroppings and meadows) are not only attractive, but also ecologically sound.

"The commonplace is the thing, but it's hard to find."

- Andrew Wyeth
"The Helga Pictures", 1987

VIEWSHED ANALYSIS

The viewsheds of the East Mountain Area should be mapped and delineated to determine the best approach for preserving or improving the visual character of the area. The delineation of viewsheds would also be helpful in establishing area planning districts, and in the siting of future development.

The viewshed starts at the transition between the development of a village and the surrounding landscape. To determine the extent of the viewshed, important vantage points and significant features in a village should be identified. Foreground, middle ground, and background views should be assessed, and sensitivity (or relative importance) of each view classified. Effects on views should become an integral part of the evaluation of proposed future developments in the East Mountain Area.

AIR QUALITY

The East Mountain Area's air quality is one of its most attractive environmental resources. According to the most recent opinion survey, one of the most significant reasons why people choose to live in the East Mountain Area is the fresh air. While the eastern slopes now enjoy an abundance of clean, uncontaminated air, it is important to remember that as population and associated activities increase it will be necessary to guide land use and community development toward strategies and solutions that are respectful of this aspect of the environment.

Air quality conditions were monitored in the East Mountain Area at the Roosevelt Middle School in the Village of Tijeras form 1975 to 1979 by the State of New Mexico, Health and Environment Department, and Environmental Improvement Division. The only air quality concerns at that time were particulates resulting from wood-burning in residential areas, dust from unpaved roads and construction sites, and the Ideal Cement Plant, which is located in the village of Tijeras, south of I-40 and west of South 337. During that time very low levels of every monitored pollutant were recorded, indicating that the air pollution levels that people were exposed to was acceptable and well below federal standards for air quality. Monitoring efforts were discontinued in 1979 because no significant air quality problems were found to exist.

Air quality has not been monitored in the area since that time. It is probably idealistic to assume that area residents will restrict their pollution output uniformly without guidelines to follow. Population and pollutant concentrations must be monitored in order to determine how location and type of development will affect the East Mountain Area's airshed. Such an approach will safeguard air quality by guiding development to be more respectful of the environment.

It is generally recognized that air quality is best maintained by state and local government action in conjunction with national emission standards, matching funds, and with federal authority to step in and take over where performance lags.

AIR QUALITY MAINTENANCE

1. Auto Emissions

   Air quality is preserved by keeping automobile emissions low, or by dispersing pollutants into a larger volume of air, thereby reducing concentration of air pollution. Reduction of emissions can be accomplished by limiting the number of vehicles or dispersion units in an area, by mechanical improvements, and by applying enforceable standards and controls on their maintenance and use.

2. Scale of Roadways

   A hierarchy of roads can be developed to serve high volume traffic where necessary while keeping roadways at a reduced scale where traffic volumes are lower, thereby reducing air pollution while respecting the rural character of the area.

3. Alternate Transportation

   Facilities for walking, bicycling and horseback riding for recreation can be provided, thereby reducing the need for travel by automobile.

4. Atmospheric Circulation

   Source areas of pollution can take advantage of prevailing winds and breezes if related drainageways are left unobstructed so that there is a free flow of air movement.

5. Dust Control

   Use of top soil disturbance permits and dust control plans for construction sites, and the paving or gravel surfacing of dirt roads will reduce dust from these sources without greatly increasing traffic speeds or runoff.

6. Landscaping

   Landscaping of bare areas and preservation of native vegetation in areas not under active construction will reduce dust.

7. Buffer Zones

   Buffer zones minimize adverse impacts of pollutants on a specific area by reduction of human exposure to the pollution source. Areas most sensitive to air pollution are schools, playgrounds, residential areas, and places where people congregate. Vegetative buffer zones reduce the impact of air and noise pollution.

8. Wood-burning Emissions

   Use of more environmentally sensitive woodstoves in all new construction will begin to reduce emissions caused by the uncontrolled burning of wood.